FOR OFFICIAL USE ONLY

JPRS L/10183

14 December 1981

East Europe Report

SCIENTIFIC AFFAIRS

(FOUO 11/81)

FBIS FOREIGN BROADCAST INFORMATION SERVICE

FOR OFFICIAL USE ONLY

NOTE

JPRS publications contain information primarily from foreign
newspapers, periodicals and books, but also from news agency
transmissions and broadcasts. Materials from foreign-language
sources are translated; those from English-language sources
are transcribed or reprinted, with the original phrasing and
other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets
[] are supplied by JPRS. Processing indicators such as [Text]
or [Excerpt] in the first line of each item, or following the
last line of a brief, indicate how the original information was
processed. Where no processing indicator is given, the infor-
mation was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are
enclosed in parentheses. Words or names preceded by a ques-
tion mark and enclosed in parentheses were not clear in the
original but have been supplied as appropriate in context.
Other unattributed parenthetical notes within the body of an
item originate with the source. Times within items are as
given by source.

The contents of this publication in no way represent the poli-
cies, views or attitudes of the U.S. Government.

JPRS L/10183

14 December 1981

EAST EUROPE REPORT

Scientific Affairs

(FOUO 11/81)

Contents

CZECHOSLOVAKIA

- a -   [III - EE - 65 FOUO]

CZECHOSLOVAKIA

FACTORS IN INCREASED AUTOMATED MANAGEMENT SYSTEM RELIABILITY

Prague INVESTICNA VYSTAVBA in Czech No 6, Jun 81 pp 196-201

[Article by Eng Frantisek Marek: "Preconditions for Reliability of Automated Management System Hardware"]

[Text] At the end of 1980, the Federal Statistical Office published data in the specialized press on the status and utilization of data-processing equipment in Czechoslovakia in 1979 which merit consideration, for as of 1 January 1980 the purchase value of basic data-processing equipment in the republic reached Kcs 18.77 billion, in addition to a value of Kcs 2.1 billion in buildings and construction work.

Nonetheless, no fundamental changes had been achieved in time utilization of installed data-processing equipment; for digital computers, for example, the figure was 91.1 percent in two-shift, 5-day operation, and of this, only 74 percent was productive work. In addition to a number of important factors, particularly involving automated management system (ASR) software, it is of particular importance in data-processing-equipment utilization to improve the operating reliability of ASR hardware, for maintenance accounted for 8.6 percent and down time for 5.6 percent of the total use time of digital computers in 1979.

It is understandable that a critical role in the improvement of technical standards and operating reliability of ASR hardware must be played by the producer, by both provision of modern, reliable components, and assurance of the technical and software relaibility of computer and controlsystems, including design of their operating systems, memory protection, data protection during collection and transmission, and the like. The new technology for producing logical circuits itself considerably increases the reliability of data-processing equipment, especially since it has eliminated the numerous electrical connections required in the past. Another important influence is the quality of applications software (restarts with check-points, emergency control of the program or process during a computer breakdown, data protection in data bases and the like), as well as regular servicing of the hardware and the organization of comprehensive maintenance, not to mention a sufficient supply of spare parts and assemblies.

Nonetheless, creating the preconditions for maximum operating reliability of ASR software must become an inseparable part of the preparation and design documentation for construction projects. This especially involves the area of process control

1

(where classical methods of control and regulation are increasingly being replaced by microprocessors), but also applies to aviation, nuclear engineering and medicine, where the automated management system is a factor which is increasingly affecting the technical and economic parameters of construction projects and equipment.

The critical measures which should be carried out following evaluation of their economic effect, especially in the case of capital construction, can be classified in the following categories:

    --hardware configuration;
    --power supply;
    --climate control;
    --facilities for maintenance.

Hardware Configuration

One important factor in this area is optimization of the number of components and the level of capabilities of the equipment. As regards the computers themselves, essentially antithetical tendencies are emerging in the design of enterprise auto-mated management systems (ASRP) and design of the lower levels, i.e., automated control systems for production procedures (ASRVP) and for manufacturing processes (ASRTP). While at the ASRP level extremely powerful computer facilities are installed, in accordance with the size of the enterprise, with immense external disk storage capacity for the creation of enterprise-wide data bases, in terms of reliability it is much more advantageous at the ASRTP level to divide the con-trolled process into smaller sections which are controlled by stand-alone mini-computers or microcomputers.

In designing ASR's, it is also beneficial to devote attention to the selection and integration of suitable sensors and measuring devices so as to achieve a maximum quantity of important information with a minimum number of installed sensors and interfaces, which are the most common source of breakdowns in operation. The same applies in planning and the number and location of terminals. To assure operating reliability of terminals and associated systems, where both the human factor (in this case generally the regular personnel of the workplace where the terminal is installed) and the economic consideration of expenditures on the purchase and operation of terminals and their control units and communication lines play important roles, it is necessary to keep the number of terminals from being uneconomically large, but also to install them only in certain control centers to which data flows from other associated work stations.

An important factor which may help improve the reliability of ASR hardware is that of limiting the selection, along with a certain degree of standardization of computers and their peripheral equipment and terminals; in practice, this is taken care of for the immediate future by the use of the Unified System of Electronic Computers (JSEP) and the Unified Ssstem of Minicomputers (SMEP). Of course, there is an economically based optimum here as well. The selection of suitable computer or hardware items for data collection and transmission requires that they be suited to the tasks which they are required to perform within the ASR at the level and location in question.

Of the greatest importance in terms of operating reliability is the design of backup provisions or replaceability of subsystems, central processors, transmission paths, peripherals, terminals and sensors, for either dealing with or preventing breakdowns. It is entirely logical that economic considerations percent the provision of 100 percent reserve capacity (because there is almost no case where it would be economical, for example, to back up an ASRTP with classical-type regulation, including instrumentation and personnel), nonetheless it should be possible while eliminating a malfunction--and depending on the priority of the individual programs--to assure the operation of at least a reduced system from which certain less important functions are eliminated, or to carry on certain system functions with slower response time.

The common practice of doubling the most important operating sensors so as to assure that the control system operates even if some sensor fails has proven effective. Also beneficial are redundancy of certain peripherals (e.g., printers for batch-processing computers), arrangement for a backup means of providing calculation results (e.g., on a display instead of a printer , and, in important applications, redundancy of central processors with the possibility of interconnection of peripherals and external sotrage.

Perhaps the ultimate in operating reliability, which, however, because of purchase and operating costs, is justifiable only in extraordinary cases involving direct real-time control of certain important processes, is the use of a fully duplexed system of two interconnected computers. In such a system, both computers work simultaneously on the same task and compare their results or checksums, so that they can quickly discover errors. The classical duplex system consists of two central processing units, each connected with a direct-access external store and an operator's console. The other peripherials, particularly punchcard or punched-tape input and output devices, printers, terminals and the like, are generally common to both computers. One of the computers functions actively, the other passively. In data collection, the input data are fed to both computers, which process them. The active computer furnishes the results, while output is suppressed in the passive computer. If it becomes necessary to fix a malfunction or to repair the active computer, the two computers exchange functions, and the active computer stops and begins to diagnose its malfunction. If there is a malfunction in the passive computer or if it is to be repaired, it may imm diately be taken off-line for repair. An unquestioned advantage of the fully duplexed system is the constant possibility of debugging and testing new programs or making program cnanges while the system is in operation.

In the NHKG [Klement Gottwald New Metallurgical Works], two Hewlett-Packard 1000/31 computers (Fig. 1) are currently in operation in the ASRTP system of the central oxygen converted shop, controlling two oxygen units with capacities of 35,000 Nm^3 of oxygen per hour each. For better operating reliability, a parallel redundant system (Fig. 2) is used, in which each computer, while it directly controls only its own oxygen unit, also accumulates permanent data on the other unit. If a malfunction in one of the computers is detected by the computer malfunction logical unit, the outputs to both oxygen units are connected to the other computer, which takes on the essential control functions for the entire oxygen converter shop.

3

FOR OFFICIAL USE ONLY

Fig. 1. Computer for control of NHKG's central oxygen converter shop.
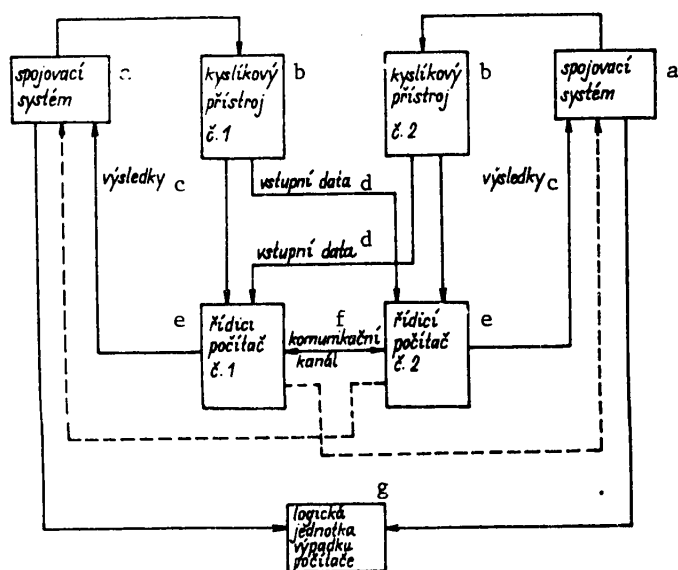
Obr. 2. Schéma záskokového propojení počítačů pro ASŘTP centrální kyslíkárny

4

FOR OFFICIAL USE ONLY

Fig. 2. Backup provisions for computers in ASRTP of central oxygen converter shop.

Key: a. Communications system
b. Oxygen unit (No 1, No 2)
c. Results
d. Input data
e. Control computer (No 1, No 2)
f. Switched channel
g. Computer malfunction detection unit

To provide for communication between the two computers, which are located side by side in a single room underneath the shop's control room, an HP 91700 A communications unit is used, allowing interchange of data at 1 million bits per second, with data exchange between the two computers proceeding via working memory by means of a pair of programs. This redundant system of two computers unquestionably has allowed further improvement of the operating reliability of the entire system, which is in constant use in continuous three-shift operation. In practice this has eliminated all planned switching-out of the individual computers for scheduled repairs. Currently the operating reliability figure for the entire system is 0.984 with the only important remaining factor being availability of spare parts.

NHKG has also instituted interconnection between two central computers located together in one room by using common peripherals for input and output (Fig. 3). This has also created optimal conditions for simultaneous performance of two separate types of work: direct teleprocessing of data, including an interactive system for running documentation and the planning of production, sales and transport is done in the faster, more powerful computer, an IBM 370/148, while batch processing of data is done on a 370/145 computer, which is also used for interactive programming.

FOR OFFICIAL USE ONLY

Fig. 3. IBM 2914 unit, allowing slow peripherals to be connected to both computers.

Another possibility for assuring reliability of a real-time system, which also makes possible continual system development, is the installation of a backup computer, which can be used for debugging and testing of new programs and for making program changes, and in case of a breakdown, as a substitute for the computer that is out of service. NHKG used this arrangement in designing a system for controlling and monitoring the production in a medium-light section rolling mill, where a system of three control computers is backed up by a fourth (Fig. 4), allowing further development of the ASR for four rolling trains and production of an expanded selection after 1982; this year two rolling trains producing a limited selection are being put into operation.
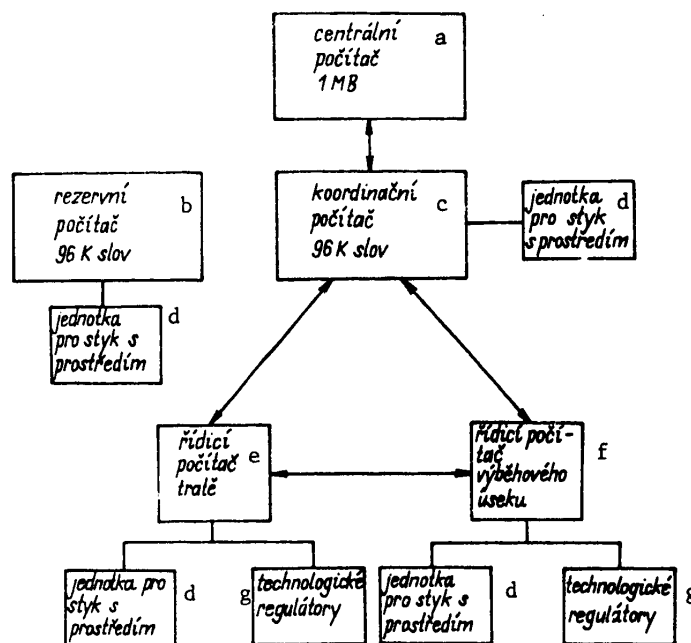
Obr. 4. Schéma technického vybavení ASŘ středojemné válcovny NHKG

Fig. 4. Hardware for ASR of medium-light section mill in NHKG.

Key: a. 1 Mbyte central computer
      b. 96 Kbyte backup computer
      c. 96 Kbyte coordinating computer
      d. Unit for interface with surroundings
      e. Rolling train control computer
      f. Runout section control computer
      g. Process regulators

6

FOR OFFICIAL USE ONLY

Electric Power Supply

In capital construction, two requirements are imposed on the power supply for computer and control systems:

--continual, uninterrupted supply of electric current, with the exclusion of even brief interruptions on the order of milliseconds;

--minimal voltage and frequency fluctuations of the power supply: generally the voltage tolerance required is ± 8 to 10 percent of the average value, while for microprocessors the figure is only 3 percent; the frequence tolerance is ± 1 percent, i.e., 50 Hz ± 0.5 Hz.

Particularly in the control of continuous manufacturing processes, but also in medicine and aviation, use of equipment for uninterrupted supply of electric power is of steadily increasing importance. For powering computers and minicomputers, two main technologies are used:

--a rotary converter with a diesel unit, which goes into operation when there is a power grid outage and drives the generator which produces power for the ASR hardware. This design is of course common with a number of other types of equipment; makes heavy demands as regards structural modifications, and its operation involves considerable noise and sizeable energy losses, in addition to which it cannot be started up immediately when there is a power failure;

--a static converter, in which electrical energy is accumulated in storage batteries (Fig. 5). In this case, AC current from the power system is first rectified by a thyristor rectifier, which provides direct current both for charging the electric batteries and for powering the alternator, which again converts the DC current to AC of the required voltage. The function of the battery is to power the computer or control system during a power failure long enough for all the necessary computations to be completed and the results to be read out or stored in memory, and possibly for the reserve power source to be started (generally after 10 minutes to an hour).

7 .

Fig. 5.

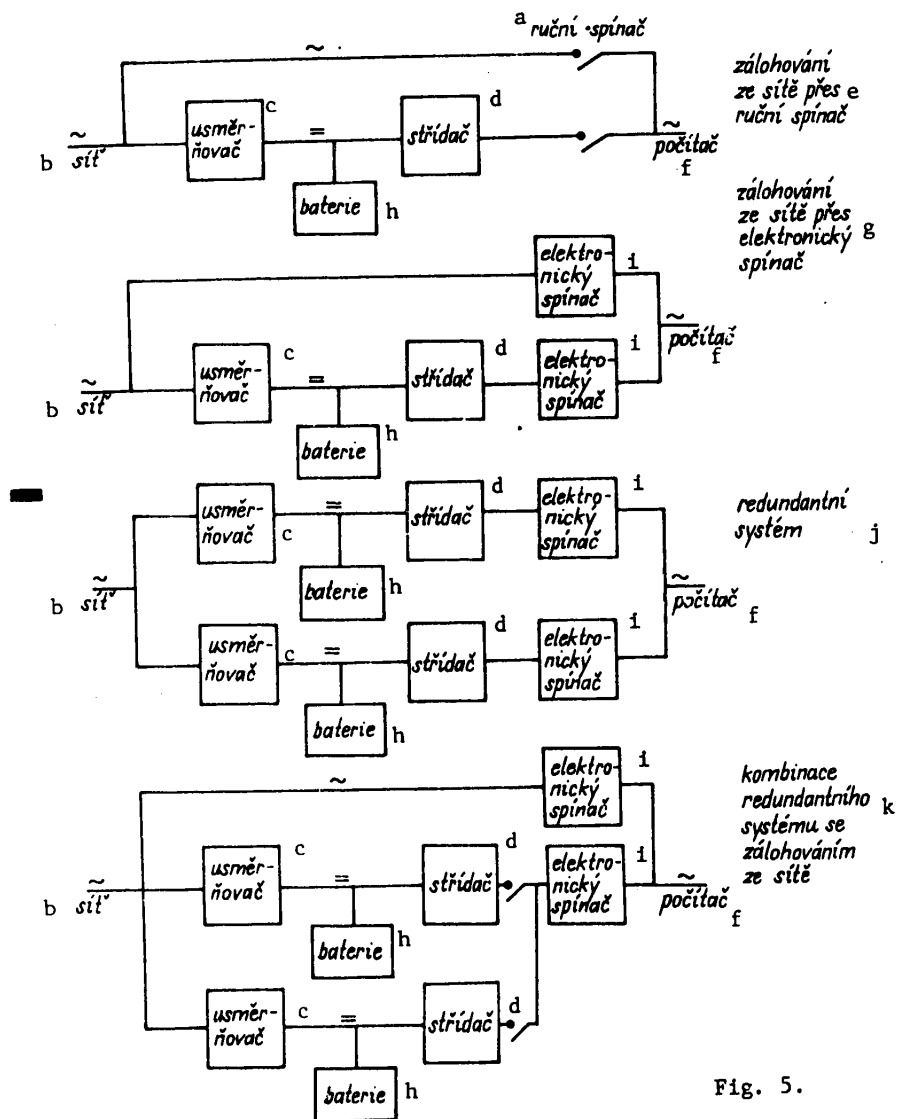Fig. 5. A static converter and ways of providing redundancy.

Key: a. Manual switch   f. Computer
      b. Power grid   g. Backup from grid via electronic
      c. Rectifier   switch
      d. Alternator   h. Battery
      e. Backup from grid, via manual switch   i. Electronic switch
                                                    j. Redundant system
                   k. Combination of redundant system and backup from grid

8

Y

The static converters are made up of electronic power components, thyristors and diodes, which in addition to good reliability also have very good efficiency, and require less structural modification than rotary converters. They have the additional advantage of eliminating current peaking, maintaining voltage and frequency stability, and providing complete phase symmetry. They require less space and auxiliary equipment, and are less demanding as regards foundations, since they involve no vibration. In addition, they are noiseless.

To assure a continuous power supply, but also to deal with failure or repair of the converter, it is desirable to provide backups for these continuous sources. This is done either by backing them up directly from the AC grid, with manual or electronic switching, or by using a redundant system of several parallel units for continuous power supply, or by a combination of a redundant system with backup supply from the power grid. (Fig. 5).

The use of converters for continuous power supply may be of especial practical importance when they are produced domestically. EVU [Power Research Institute] Nova Dubnica has developed a single-phase source for continuous power supply to the TESLA RPP 16 computer. The national enterprise Elektropristroj [Electrical Equipment] Modrany has begun production of the TZNP type static converter with a power of 25 kVA and has also developed 2.5, 6 and 12 kVA single-phase converters.

NHKG has installed static converters for uninterrupted power supply in the control systems of the central oxygen converter shop and medium-light section will. A domestically produced converter from Elektropristroj Modrany with a capacity of 25 kVA is used to power the ASRTP of the converter shop. In the case of the ASR for the medium-light section mill, where the continuous power supply must power four control computers and a number of terminals connected with the central computers, it was necessary to select a static converter with a higher power, and accordingly a 45 kVA converter from the Swedish Asea Co was installed (Fig. 6).
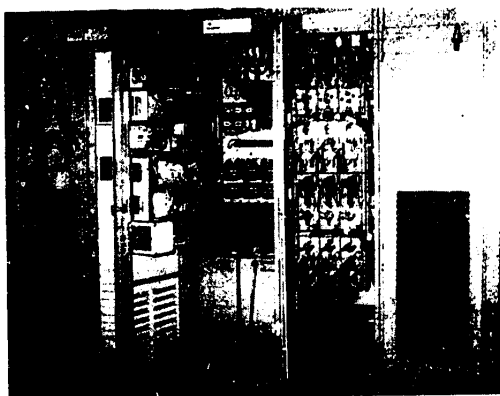

Fig. 6. 45 kVA continuous power supply.

9

FOR OFFICIAL USE ONLY

The installation of static converters must have evident economic justification. In cases where these are not absolutely essential, it is helpful to provide a computer or control system with at least a backup power source in case the main power source fails.

Continuous power supply is much more important in the case of microcomputer systems. Generally this does not require power equipment, because it is necessary only to provide 5 and 12 volt DC current, to prevent even brief power supply interruptions and to assure a smaller voltage fluctuation. Protection of data in memory is important.

Here, too, two main types of equipment are considered, both using reserve batteries:

--a static converter (Fig. 7) assures continuous DC current for the entire system on in essentially the same manner as for [larger] computer systems. This design is, however, more costly than a battery power supply and moreover involves superfluous conversion of some DC current to AC;

--a stabilized DC power supply from reserve batteries: the main component here (Fig. 8) is again a rectifier, which converts AC current from the power grid into variable-voltage DC. The other component is a charger, which supplies constant-voltage DC for three purposes, namely slow constant charging of the batteries to full voltage, fast charging of the batteries when they have been discharged and powering of DC converters. Among other things, the control logic is used to isolate the charger from the battery in case of a power failure, in addition to which a switching relay is used to disconnect the battery from the circuit if its voltage drops to the minimum permissible bv value. A 12-volt battery is used as the system power supply source when the power supply from the grid is out. The DC converters also provide the required 12 and 5 volt current, generally with tolerances of ±3 percent of these values.

Two variants of this approach are possible: the first is a system which assures uninterrupted DC power only for the processor, the memory and other components with LSI circuits, while the peripheral equipment is supplied from the standard AC grid (Fig. 9); the other alternative is a system which provides a constant power supply to the memory even when the standard power supply is off (Fig. 10), for example when the processor is not in operation.

10

Fig. 7.

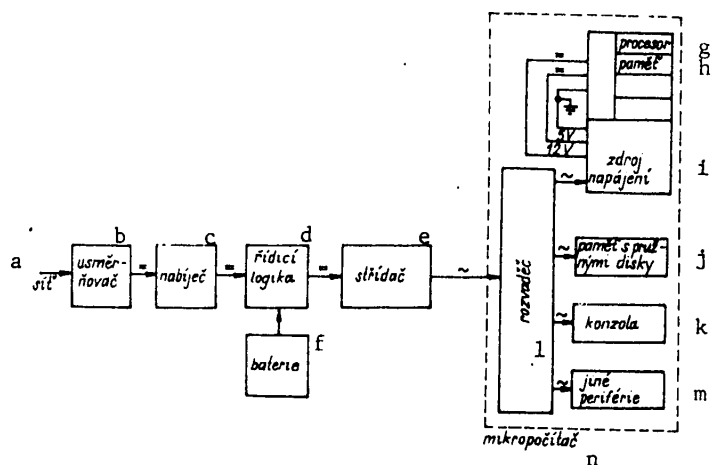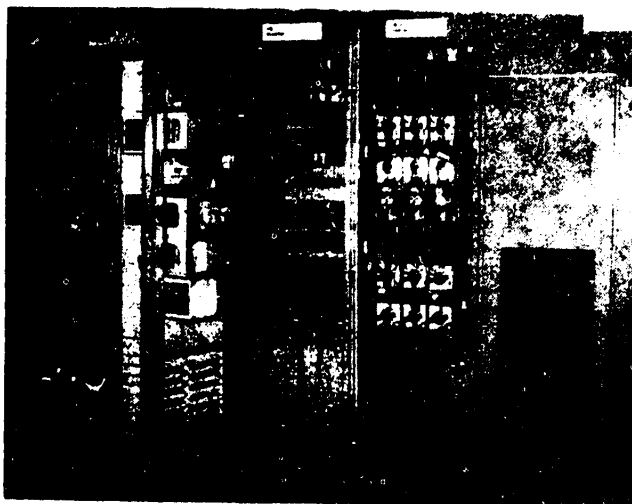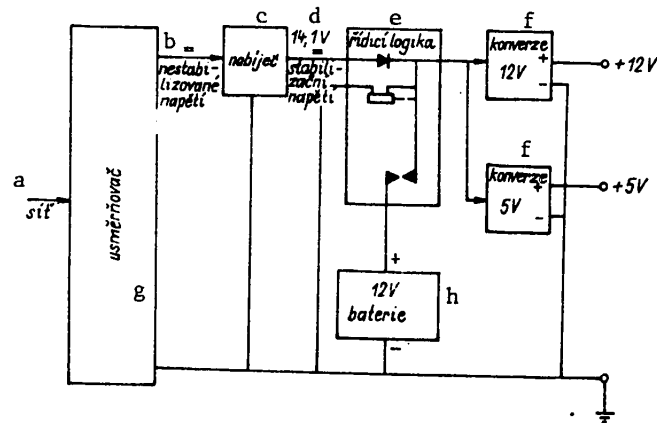Fig. 7. Provision of uninterrupted power for a microcomputer, using a static converter.

Key:
a. Power grid
b. Rectifier
c. Charger
d. Control logic
e. Alternator
f. Battery
g. Processor

h. Memory
i. Power supply
j. Floppy disk memory
k. Console
l. Distributor
m. Other peripherals
n. Microcomputer

11

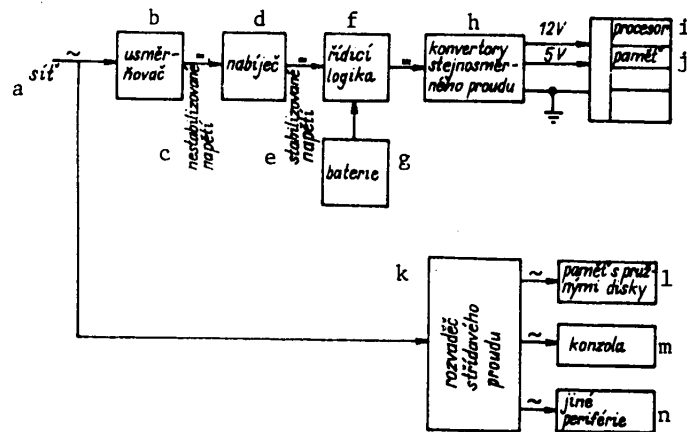**Obr. 8. Schéma zdroje stabilizovaného stejnosměrného napětí s rezervní baterií**

Fig 8. Stabilized DC source with reserve battery.

Key: a. Power grid   e. Control logic
      b. Nonstabilized voltage f. Conversion
      c. Charger   g. Rectifier
      d. 41.4V stabilized voltage h. Battery

Obr. 9. Nepřerušovaný zdroj proudu pro LSI obvody

Fig. 9. Uninterrupted power supply for LSI circuits

Key: a. Power grid   c. Nonstabilized voltage
      b. Rectifier   d. Charger

12

e.	Stabilized voltage	j.	Memory
f.	Control logic	k.	AC distributor
g.	Battery	l.	Floppy disk memory
h.	DC converters	m.	Console
i.	Processor	n.	Other peripherals
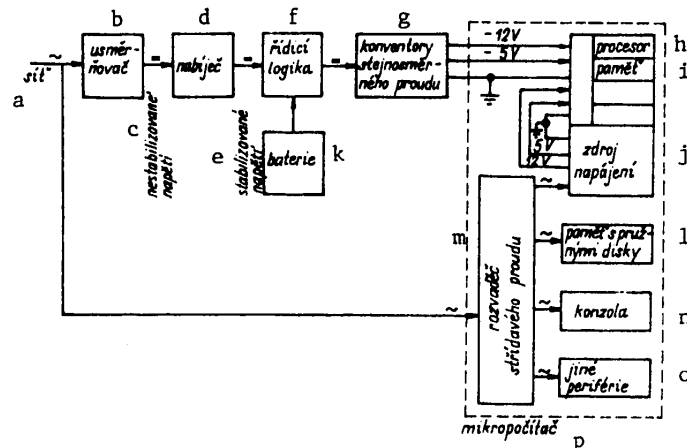
Obr. 10. Zdroj pro trvalé napájení hlavní paměti

Fig. 10. Constant power source for main memory

Key:
a.	Power grid	i.	Memory
b.	Rectifier	j.	Power supply
c.	Nonstabilized voltage	k.	Battery
d.	Charger	l.	Floppy disk memory
e.	Stabilized voltage	m.	AC distributor
f.	Control logic	n.	Console
g.	DC converters	o.	Other peripherals
h.	processor	p.	Microcomputer

While the provision of an interrupted power supply applies only to important, generally continuous, real-time ASR applications, it is also desirable to meet the requirement for a power supply with minimum voltage and frequency fluctuations for computers for mass data-processing, table top and office computers, terminals, and also possibly equipment for data collection and transmission.

In the case of computers with large power consumption, it is sometimes necessary to install a rotary stabilizer. A domestic supplier is the BEZ [Bratislava Electrical Engineering Factories] national enterprise in Bratislava. But it is always advantageous to assure a power supply to the computer independent of that for climate control and other large power consumers, or to supply the computer or control system

13

with its own transformer, which somewhat decreases the effects of power-grid fluctuations. Finally, the importance of adhering to the requirements regarding the grounding of data-processing equipment, and particularly of maintaining the same ground resistance in a computer and its terminals, should not be underestimated.

Climate Control

The following climate-control requirements apply in the design and construction of computer and control centers:

--meticulous adherence to prescribed operating conditions, particularly regarding temperature, humidity and freedom from dust, in addition regarding minimum sulfur dioxide content in the case of a chemically aggressive atmosphere. Associated with these requirements are provision for monitoring and recording the conditions in question (air temperature and humidity), monitoring of the operation of climate-control equipment, and possibly provision of warning signals when the prescribed conditions are not met or the climate-control equipment breaks down;

--minimum energy consumption, and a separate power supply, independent of computer power supply;

--small size and easy accessibility for servicing and maintenance;

--low noise level, which is particularly important in the case of compact climate-control units located directly in the computer room, in which case it is desirable that the noise from these units not exceed that of the installed data-processing equipment;

--maximum operating reliability and service life.

Two somewhat contradictory tendencies have currently taken shape as the demands for climate control for data-processing equipment have developed. One is the introduction of modern processes for the production of electronic components (minicomputers and microcomputers, but also the CPU's of the latest-generation digital computers), which is associated with decreased climate-control requirements owing both to a decrease in the heat given off by new types of processors and to the prescribed temperature and humidity requirements. Currently, the air temperature requirements for the human operators are more demanding than those for failure-free computer operation; experience confirms that human workers have maximum productivity at temperatures between 20° and 24° C and humidities between 40 and 55 percent. In addition, the number of devices which must be noncentrally located in ordinary manufacturing or office conditions and which are intolerant only of water condensation is steadily increasing.

In contrast, however, as the track density and the recording density on an individual track, or the capacity of external magnetic storage in general, increases, so do the demands for cleanliness of these storage units' working environment. The greatest demands for freedom from dust are imposed on the operation of magnetic disk stores; extraneous particles entering the space between the magnetic surface of the disk itself and the read-write head (which are between 0.8 and 4 microns apart) can damage both the disk and the head mechanism. Tests of a 7.25 Mbyte disk memory unit

14

operated in nonfiltered city air indicated that the disk pack and the heads were ruined in a maximum of 30 days.

The producers of disk storage units are trying to prevent dust particles from getting between the disk and head. In the case of fixed disks, the unit is sealed, while in the case of replaceable disk packs and cartridges the air which enters the storage unit is filtered and an overpressure is created in the pack area so that any dust will not be sucked into the disk pack during rotation, but instead will be blown away from it.

As a result of energy requirements and investment costs, primarily compact, air-cooled climate control units are now used with data-processing equipment. Most of these are units produced under license from Hiross-Denco by Vzduchotechnika [Air Engineering] national enterprise in Nove Mesto nad Vahom. For smaller data-processing devices, the SPD 800 unit from LVZ [?Liberec Air Engineering Plant] Liberec, or the KT1 and KT2 units imported in limited numbers from the GDR, may be used. To illustrate the climate-control requirements of JSEP and SMEP computers, Table 1 gives the prescribed working conditions for computers.

(1) Tabulka I. Přehled požadavků na pracovní prostředí počítačů

(2) Veličina	(3) Měrná jed-not-ka	(4) Typ počítače					
		EC 1011 1010	EC 1021 1025	EC 1030 1033	EC 1040 1055	SM 3.20 4.20	ADT 4000
(5) teplota vzduchu	˚C	22	23	22	23	20	23
(6) dovolená tolerance	±˚C	4	2	1	2	5	2
(7) relativní vlhkost vzduchu	%	50	55	52	50	65	55
(8) dovolená tolerance	±%	10	10	7	7	15	10
(9) prašnost	mgm⁻³	—	1	1	0,5	0,8	0,2
(10) maximální rozměr pracho-vých částic	μm	5	3	3	3	1	
(11) dovolený obsah SO₂	mgm⁻³	0,4	—	0,005	2	20	

Table 1. Survey of requirements for computer working environments.

Key: (1) Table I Overview of Requirements of Working Environments for Computers
     (2) Item
     (3) Unit of measure
     (4) Type of Components
     (5) Air temperature

15

    (6) Permitted tolerance
    (7) Relative humidity
    (8) Permitted tolerance
    (9) Dustiness
  (10) Maximum dimensions of dust particles
  (11) Permitted content of SO_2

Maintenance Facilities

Maintenance has a major effect on the operating reliability of ASR hardware. Nonetheless, even within the context of capital construction it is possible to create the necessary conditions for maintenance activity, whose performance does of course require an optimal concentration of manpower and faci equipment, in either a specialized NOTO [National Organization for Technical Services (Computers)] service or specialized automation equipment service as a part of a large industrial enterprise.

Primary attention should be devoted to the following:

--construction of the necessary areas for maintenance work in the immediate vicinity of the computer room, including optimal areas for storage of spare parts and technical documentation;

--provision of suitable measuring and testing instruments for maintenance work, particularly oscilloscopes, multimeters and the like;

--provision of maintenance workers or operators with portable equipment for cleaning and testing of magnetic tapes;

--provision of suitable portable equipment for cleaning and visual and mechanical testing of disk cartridges or packs;

--provision of spare display or teletype terminals and matrix printers, as well as other peripheral equipment in cases where exchange and repair of assemblies is practiced (Fig. 11);

--provision of suitable transport facilities for rapid transport of workers for repair work or exchange of noncentrally located data-processing equipment.
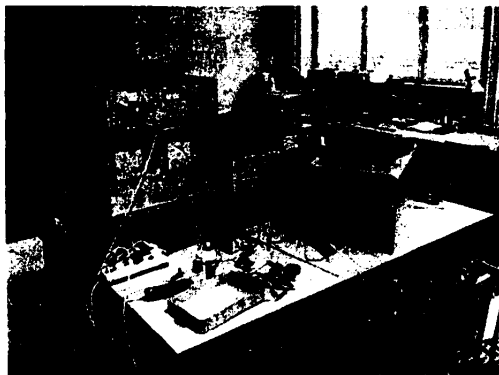
Fig. 11. Repair of a VT 340 display in the EC 1010 computer workshop of the NHKG central oxygen converted shop.

Nor would it be logical to undervalue the important function of data-processing personnel, particularly in automatic testing of computer and control systems during operation, and in regular provision and systematic updating of the relevant technical documentation (including management of the updating work).

In creating the conditions for maximum operating reliability of ASR hardware as part of capital construction, primary attention must be given to the economic point of view. In particular, the provision of certain high-investment features, such as continuous power supply, a duplexed system of two computers, a reserve computer, duplication of peripheral equipment or an increase in the number of external storage units, must always have economic justification.

The importance of all of these measures naturally will increase if data-processing equipment is to be used in continuous three-shift operation, when it is impossible to eliminate malfunctions in special night, Saturday or Sunday shifts, and particularly in the case of real-time operation, in the control of important manufacturing processes, in medicine, aviation or nuclear engineering.

The equipment producer and domestic supplier (NOTO organization) will always have an extraordinary position in creating the conditions for maximum operating reliability of data-processing equipment, both in building up sizeable stores of spare parts and equipment for maintaining and repairing defective logical circuits.

COPYRIGHT: SNTL, Nakladatelstvi Technicke Literatury, Prague, 1981

8480
CSO: 2402/78

END
17